

Do Sex and Ethnic Differences in Smoking Initiation Mask Similarities in Cessation Behavior?

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Cigarette smoking remains the most important contributor to preventable morbidity and mortality in the United States.¹ Promotion of smoking cessation is a public health priority, but it continues to be the case that most individuals who successfully quit smoking do so on their own, without the aid of formal programs.²⁻⁷ Among individuals who have quit on their own, data from many epidemiological studies suggest that men are more likely to quit than are women,^{5,8,9} and Whites more likely to quit than Hispanics or African Americans.^{5,10-15} Results regarding sex and ethnic differences in cessation have not, however, been consistent.^{16,17} Specifically, when duration of smoking has been taken into account,¹⁶ no differences in quitting behavior have been found.

In this study, we examined ethnic and sex differences in successful quitting, taking duration of smoking into account. Elapsed time from smoking initiation to cessation ("time to quit") was defined as individuals' reported age at quitting minus their reported age at initiation. This quantity approximates duration of smoking (it does not adjust for time off smoking due to quit attempts) and serves as an individual-level measure of successful quitting. In the framework of survival analysis, time to quit (or duration) is considered a "failure time," a strategy that allows cessation to be viewed as a dynamic population process.

Conceptualizing cessation as a population process brings observational and measurement issues to attention. Specifically, it forces consideration of the possibility that the results of a process measurement taken at one point in time may differ from the results of the same measurement taken at a later time as a consequence of the time evolution of the process. We analyzed data sets collected in 1987 and 1996 in an effort to assess this possibility and its implications. We addressed the possibility of cohort differences in quitting behavior (generational trends) by constructing and

Objectives. This study compared success in smoking cessation by sex, ethnic status, and birth cohort.

Methods. African and European American respondents to the 1996 Current Population Survey (tobacco supplement) and the 1987 National Health Interview Survey (cancer control and cancer epidemiology supplements) constituted the study population. Elapsed time from smoking initiation to cessation was compared via nonparametric tests and survival analysis techniques.

Results. Findings showed that success in quitting was independent of ethnic status and sex and that population differences in smoking initiation age (assuming no differences in quitting behavior) could produce statistical associations between sex/ethnicity and smoking cessation.

Conclusions. Population differences in smoking initiation patterns can mask similarities in cessation rates. (*Am J Public Health.* 2002;92:961-965)

comparing birth cohorts with respect to time-to-quit values.

METHODS

Data collected in 2 national surveys, the Current Population Survey (CPS) of January 1996 and the National Health Interview Survey (NHIS) of 1987, were used in analyzing smoking cessation. Both the CPS and the NHIS are ongoing surveys targeting the civilian, noninstitutionalized population of the United States.

The NHIS is conducted by the National Center for Health Statistics and serves as the principal source of information on the health of the US population. In this survey, a multistage probability design is used to select sample households representative of the target population. Within selected households, information on all adult members (18 years or older) is collected by trained interviewers.¹⁸ In 1987, tobacco use and other cancer-related information was assessed at the national level via supplementary cancer control and cancer epidemiology questionnaires.

The CPS is conducted by the Bureau of the Census and serves as the source of official government statistics on employment and unemployment. This survey also involves the use of a multistage probability design in se-

lecting nationally representative households. Within households, information on all members 15 years or older is collected.¹⁹ In January 1996, a tobacco use survey was conducted as a supplement to the CPS.²⁰ Proxy responses were permitted in this supplement (as shown in the first 3 CPS questions described subsequently), but these data were excluded from the analyses described here.

Information of interest in analyzing cessation was assessed via self-reports in both surveys. Variables used were derived from respondents' answers to the following questions: (1) Have you smoked 100 cigarettes in your entire life? (NHIS) or Has [household member in question] smoked 100 cigarettes in his/her entire life? (CPS); (2) Do you currently smoke cigarettes? (NHIS) or Does [household member in question] now smoke cigarettes every day, some days, or not at all? (CPS); (3) How old were you when you first started smoking cigarettes fairly regularly? (NHIS) or How old was [household member in question] when he/she first started smoking cigarettes fairly regularly? (CPS); and (4) How long ago did you stop smoking? (NHIS) or About how long has it been since you completely stopped smoking cigarettes? (CPS).

Individuals responding yes to question 1 were classified as ever smokers. Those responding no (NHIS) or not at all (CPS) to

question 2 were classified as former smokers. Age at initiation was determined by response to question 3. Finally, for question 4, time to quit was defined for each individual as reported length of time from initiation to cessation of smoking. Among former smokers, current age (in days) and reported elapsed time since quitting were used in computing age at cessation.

Among CPS respondents, age at survey completion was used to estimate year of birth (1995 minus age); NHIS respondents reported their year of birth. Ten-year birth cohorts (1896–1905, 1906–1915, . . . , 1966–1975, 1976 and later), selected for compatibility with our previous investigations,²¹ were constructed according to birth year. Data for ethnic groups other than Black or White (CPS, $n=2221$; NHIS, $n=1537$) and data for which the time-to-quit variable was missing or unknown were not analyzed.

A successful quitter was defined as a former smoker who had maintained abstinence for 1 year or longer. Initially, we assessed sex

and ethnic differences in successful quitting by comparing time-to-quit distributions using appropriate k -sample and 2-sample tests. These results did not, however, account for the complex sampling design used in the 2 surveys. Thus, another hypothesis-testing approach was taken to account for the complex design. The Kolmogorov–Smirnov statistic^{22,23} was used in pairwise comparisons of time-to-quit distributions. P values associated with these tests were adjusted, via estimation of design effect and effective sample size,^{24,25} to account for the survey design.

The adjustment procedure followed that of Kish.²⁴ For each birth cohort and each combination of 2 subdomains—race/ethnicity and sex—a weighted Kolmogorov–Smirnov statistic and associated P value were calculated. Because survey design variables were not published in the CPS data, we calculated the variances (accounting for sampling design) for Kolmogorov–Smirnov statistics estimated in that data set by considering these statistics as differences in proportions and using the gen-

eralized variance functions supplied in the documentation.

In the case of the NHIS data, we used bootstrap resampling in estimating variance.^{26,27} Specifically, we produced 200 resamples by sampling with replacement from 62 pseudostrata; 3 (of 4) pseudo-primary sampling units were sampled independently in each pseudostratum. As a means of bias reduction,²⁷ the weight associated with each selected record was multiplied by the factor 1.33 (4/3).

We then calculated design effects²⁴ for the contrast by comparing the variance with the survey design taken into account and the simple random sampling variance. On the basis of these design effects, we calculated effective sample sizes and adjusted P values.^{23,28}

RESULTS

Respondent characteristics are shown in Table 1. African Americans were oversampled in the 1987 NHIS. In those data, suc-

TABLE 1—Numbers of Respondents, by Birth Cohort, Sex, Ethnic Status, and Reported Smoking Status

Birth Cohort	All Respondents				Ever Smokers				Successful Quitters ^a			
	Black Males	White Males	Black Females	White Females	Black Males	White Males	Black Females	White Females	Black Males	White Males	Black Females	White Females
Current Population Survey, 1996: tobacco supplement												
1896	3	53	13	165	2	22	0	19	0	19	0	16
1906	42	606	106	1315	14	351	16	331	8	309	11	262
1916	124	1929	240	3051	77	1268	66	1116	47	1063	50	775
1926	179	2590	337	3381	117	1763	123	1552	63	1233	82	901
1936	271	3119	451	3919	163	2004	171	1894	72	1218	73	918
1946	424	4675	713	6027	250	2571	268	2755	75	1209	84	1185
1956	454	5037	808	6510	182	2273	280	2810	43	710	61	959
1966	344	3514	690	4487	97	1268	129	1671	13	248	16	361
1976	139	1165	190	1340	13	282	14	287	0	16	1	23
National Health Interview Survey, 1987: cancer epidemiology/control supplements												
1896	30	301	80	782	13	145	10	121	10	124	3	91
1906	156	1028	259	2107	97	699	67	627	58	523	39	367
1916	241	1771	403	2710	167	1290	153	1174	78	872	76	540
1926	261	1839	407	2322	189	1349	194	1146	74	712	61	452
1936	324	2215	499	2533	221	1550	242	1375	64	673	71	475
1946	478	3463	898	4308	287	2042	425	2065	65	772	77	688
1956	461	3443	1038	4433	216	1625	435	2128	24	401	47	540
1966	160	873	273	1040	32	271	51	351	3	26	4	49

^aFormer smokers reporting cessation lasting at least 1 year.

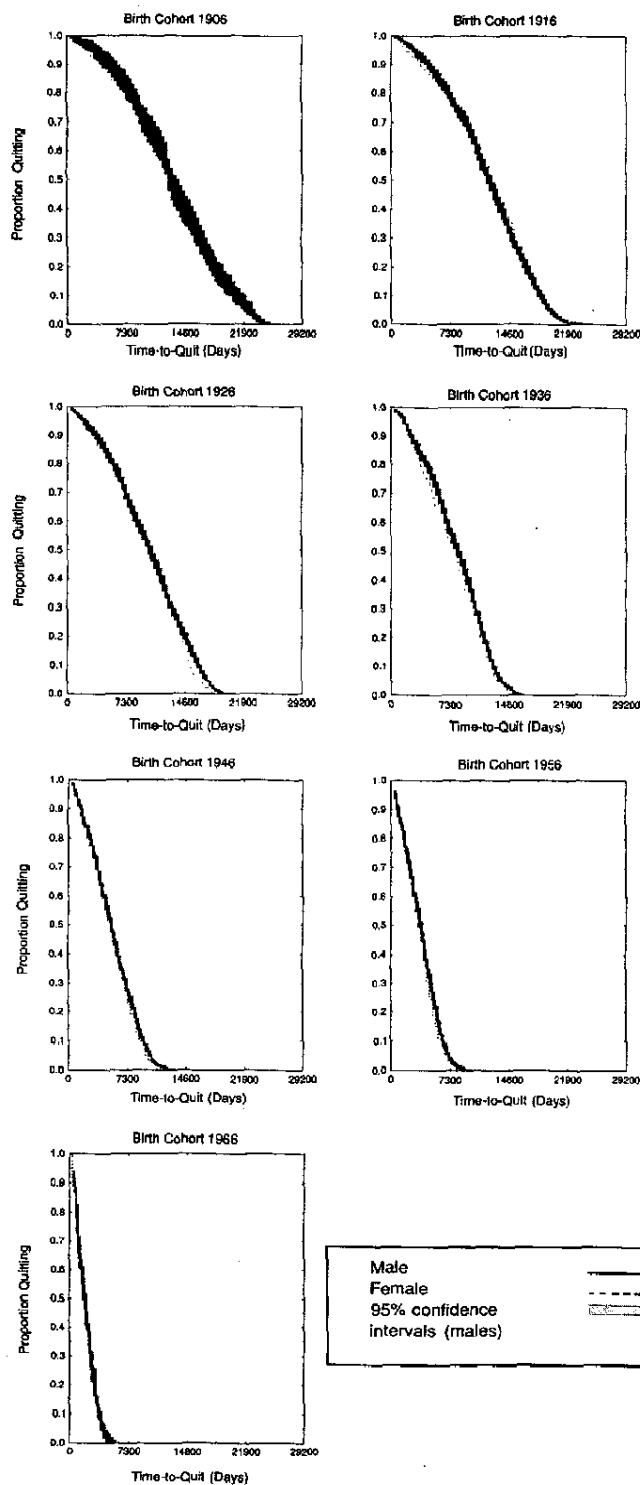


FIGURE 1—Male and female time-to-quit distributions, by birth cohort: Current Population Survey, 1996.

cessful quitters were represented in all birth cohorts, although the sample size was small for the 1896 birth cohort (Table 1). Fewer African Americans overall, and no successful quitters belonging to the 1896 cohort, were sampled in the 1996 CPS.

Figure 1 displays male and female time-to-quit distributions by birth cohort. Distributions are presented as survival curves; probabilities of successful cessation are shown on the y-axis, and time-to-quit values are shown on the x-axis. Pointwise confidence bands are included. The similarity of male and female cessation patterns is evident in all birth cohorts, with confidence bands indicating that the distributions are statistically indistinguishable. A similar conclusion held for the comparison of African American and European American cohorts (data not shown). In both cases, confidence bands were calculated with an assumption of simple random sampling. That is, the complex sampling design of the survey data was not accounted for in these results. As a remedy, hypothesis-testing procedures (as described earlier) were used, and results (available on request) confirmed that the compared distributions were statistically indistinguishable.

The quit ratio is a commonly used measure of smoking cessation in populations. We examined the proposition that 2 populations having identical time-to-quit distributions can display significantly different quit ratios if the pattern of initiation is different in the populations. If members of one group systematically initiate smoking at earlier ages than members of a comparison group, and both groups are equally likely to quit after a given duration of smoking, then the early-initiating group would be expected to contain a larger proportion of quitters at most observation times.

A Monte Carlo simulation experiment was performed to assess this proposed mechanism quantitatively. Mean prevalence rates of current smoking and quit ratios were generated for 2 populations under the assumption of identical time-to-quit distributions but differing initiation patterns. We compared quit ratios by computing a relative ratio representing the quit ratio of one group divided by the ratio of the other group.

The experiment revealed that lower mean age at initiation for one population results in

relative ratios above 1.0 that decrease toward 1.0 as observation time increases; larger differences in mean age at initiation result in larger relative ratios. Variability in initiation age has an effect independent of mean age; other factors being equal, initiation occurring over shorter periods of time in one population increases the relative ratio. The simulated prevalence of smoking is initially larger in early-initiating groups but becomes smaller in comparison as cessation proceeds. The results of this experimental simulation confirm that statistical associations of sex and ethnic status with quit ratios on the order reported in the literature could be produced by differences in mean age at initiation of 1 or 2 years.

DISCUSSION

The analyses described here lead to 2 main conclusions. First, our findings contradict previous research results suggesting that success in quitting cigarette smoking is a function of ethnic status or sex and that women and African Americans lag behind in terms of smoking cessation. The validity of these findings is supported by 2 considerations: (a) the data examined are nationally representative; and (b) results were consistent over 2 separate observations (1987 and 1996) and for all cohorts examined, whose experiences span the history of mass cigarette use in the United States. Second, given that ethnic and sex differences in initiation age have been demonstrated for African American and European American populations,²⁹⁻³² use of the quit ratio to compare cessation rates in these populations is problematic. We suspect that any measure of cessation that does not account for an individual's duration of smoking may involve similar limitations.

Two possibilities may threaten the validity of these conclusions. First, comparison of time-to-quit distributions could lead to error if reported initiation age, smoking status, or age at cessation were systematically misclassified. In the literature of which we are aware,³³⁻³⁵ evidence does not support the presence of sex or ethnic bias in reports of these variables. A second possibility is that time to quit may be misrepresented if quit attempts or time away from smoking resulting

from such attempts differ systematically between populations (e.g., if number of quit attempts or time away from smoking during attempts is systematically greater in one population). Data relating to quit attempts among former smokers were not collected in the CPS, but such data were collected in the cancer control supplement of the 1987 NHIS. Analyses of these data indicate no significant male-female or Black-White differences in either number of quit attempts or duration of most recent (or only) quit attempt.

Implications of these conclusions for smoking cessation surveillance and research are clear. With respect to tobacco use surveillance, use of the quit ratio appears to be inadequate. It is important to measure and monitor both initiation and cessation if present status and trends in smoking are to be correctly interpreted. Similarly, with respect to smoking cessation research, measures of quitting that account for duration of smoking may be most appropriate, both in analyzing factors associated with cessation and in evaluating interventions. Additional research on the relation between number of quit attempts and duration of attempts might be helpful in connecting clinical trial results to long-term successful cessation. ■

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Contributors

Both authors participated in the initial conception and design of the study. G.A. McGrady was primarily responsible for the data analysis. Both authors contributed to interpretation of data and to drafting and revision of the article.

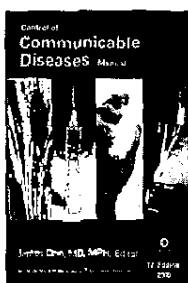
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